What are the effects of gravity on fluids in the human body?

Standards Statements:
3.1.7.E – Identify change as a variable in describing natural and physical systems.
3.4.7.D – Describe essential ideas about the composition of the universe and the earth's place in it.
National Standard:
- knows that when a force is applied to an object, the object either speeds up, slows down, or goes in a different direction.
Content Objectives:
Students will be able to:
1. Explain the affect of gravity on fluids in the human body.
2. Determine the impact of gravity changes on fluids in the human body..
3. Explain potential long term consequences of a reduced gravity environment on the function of the human body.
4. Measure using appropriate scientific units and create a graph of data.
5. Calculate percent change.
Process Objectives:
Students will be able to:
1. Create a hypothesis concerning the affects of gravity changes on fluids in the human body.
2. Write a scientific explanation of the observed effects of gravity changes on the human body.
Assessment Strategies:
1. Graphing of scientific data.
2. Written explanation of the affects of gravity change on fluids in the human body.
Procedures:
1. Introduce idea of gravity with focus on the fluids in the human body.
2. Explain laboratory procedure which will be used to investigate the impact of gravity on fluids in the body.

Suggested Level:
Intermediate/Secondary

Standard Categories:
3.1 – Unifying Themes
3.4 – Physical Science, Chemistry, and Physics

Materials:
Metric tape measure
- if unavailable use standard measure and introduce conversion factor: 1in = 2.54cm

Washable Marker
Table
Wooden blocks
Temperature Strips
Stop Watch
Graph Paper

Instructional Strategies:
Cooperative Learning
Discussion

Related Concepts:
Hypothesizing
Observing
Written Communication
Measuring
Calculating Percent
Graphing

What are the affects of gravity on fluids in the human body?

A laboratory investigation to explore the impact of gravity changes on fluids in the human body.

Thought questions to begin:
What impact does gravity have on the fluids within your body?
What impact will changing the direction of the force of gravity have on the flow of fluids in your body?
What do you expect to happen to the body as a result of a gravity change?

Investigation:
To investigate the role of gravity on the fluids in the human body, follow the following instructions carefully:
1. Measure the circumference of the mid-calf of a volunteer student while the student is standing. Carefully mark the placement of the tape measure with a marker.
2. Record this measurement in Data Table 1.
3. Place a temperature strip on the volunteer's forehead and record this data in Data Table 1.
4. Allow the student to lie down on a lab table.
5. Observe the student to "rest" for five minutes. Data should be collected from the student concerning the sensations felt in the head and upper body.
6. After five minutes measure the student's calf in the exact location as the previous measurement. Record all data collected during investigation. Measure the body temperature of the student volunteer and record data.
7. Repeat step six (6) at five minute intervals for 25 minutes being careful to record all observations.
8. Respond to "questions to ponder."
8. Construct a graph representing change in circumference over time. Time, the independent variable, should be placed on the x-axis
9. Construct a graph representing temperature changes over time.
10. Write a written explanation describing why fluid shift takes place in the human body and the impacts that this has on the human body.

Questions to ponder:
1. What is a force? What force affects the fluid flow in the human body?
2. When lying on a table, what is changed about the forces acting on the body, the size or the direction of the force of gravity? Explain.
3. What impacts of gravity can you observe on your body after a long day on your feet?
4. What changes on the body did you observe as a result of the change in gravity?
5. What long term difficulties and/or consequences might result from gravity change on the human body?
6. What might be done to counteract these difficulties?
7. What might a human living in space experience as a result of reduced gravity? How might this affect the quality of life of humans living in a space environment?

Data Table 1: Gravity and the human body

Time (minutes)	Mid-calf Circumference (cm)	Temperature (^{o}C)	Reported Sensation in head/upper body of subject

Gravity and the Human Body

Measuring Scientifically

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria	Assessment			
	Points	**Self**	**Teacher**	**Other(s)**
1. Appropriate tools, techniques, and metric units were selected and used effectively for making measurements.				
2. Measuring techniques were practiced and refined before final measurements were recorded.				
3. Careful measurements were taken in order to minimize systematic measurement error.				
4. The set of measurements is recorded in an organized way (list, table, or chart) so that patterns in the data can easily be discerned.				
5. All measurements are clearly labeled with an appropriate magnitude (numerical value) and unit.				
6. Measurements are reported to the correct number of significant figures.				
7. Alternative strategies, techniques, and measuring tools for improving measurements were examined and discussed.				
8. Multiple measurements were repeated to insure accuracy.				

O Comments O Goals O Actions

Graphing Scientific Data

Name _____Date _____ Course/Class _____

Task/Assignment _____

Expert 4	An appropriate type of graph was expertly used for the data set(s). The title of the graph clearly relates to the data displayed and reflects both the independent and dependent variables. Physical intervals on the graph are scaled appropriately and spaced evenly. All the parts of the graph are clearly and accurately labeled The set of data is plotted on the graph completely and accurately and the slope of the relationship is indicated. Colors, textures, labels, or other features are used to enhance the graph.
Proficient 3	An appropriate type of graph was used for the data set(s). The title of the graph relates to the data displayed and reflects both the independent and dependent variables. Physical intervals on the graph are scaled appropriately and spaced evenly. Most parts of the graph are clearly and accurately labeled. The set of data is plotted, with only minor errors. Colors, textures, labels, or other features are used to enhance the graph.
Emergent 2	An appropriate type of graph was used for the data set(s). The title of graph relates somewhat to the data displayed, but does not reflect both the independent and dependent variables. Physical intervals on the graph are scaled appropriately and spaced evenly. Some confusion exists as to labeling the parts of the graph. The set of data is plotted, with some errors. There is minimal use of colors, textures, labels, or other features to enhance the graph.
Novice 1	An inappropriate type of graph was used for the data set(s). The title of graph vaguely relates to the data displayed and does not reflect both the independent and dependent variables. Major problems exist with labeling the axes with an appropriate sequence of numbers based upon the range of the data. Physical intervals on the graph are not scaled appropriately nor spaced evenly. Much confusion exists as to labeling the parts of the graph. The set of data is plotted, with many errors. There is little, if any, use of colors, textures, labels, or other features to enhance the graph.

O Comments O Goals O Actions

Writing to Inform in Science (Extended Constructed Response)

Name _____Date _____Course/Class_____

Task/Assignment _____

	Development	Organization	Audience	Language
Weights ⟶				
Expert 4	Development: The writer provides accurate, specific, and purposeful scientific facts and concepts that are extended and expanded to fully explain the topic.	Organization: The writer establishes an organizational plan and consistently maintains it.	Audience: The writer provides scientific information relevant to the needs of the audience.	Language: The writer consistently provides scientific vocabulary and language choices to enhance the text.
Proficient 3	Development: The writer provides scientific facts and concepts that adequately explain the topic with some extension of ideas. The information is usually accurate and purposeful.	Organization: The writer establishes and maintains an organizational plan, but the plan may have some minor flaws.	Audience: The writer provides information most of which is relevant to the needs of the audience.	Language: The writer frequently provides scientific vocabulary and uses language choices to enhance the text.
Emergent 2	Development: The writer provides scientific facts and concepts that inadequately explain the topic. The information is sometimes inaccurate, general, or extraneous.	Organization: The writer generally establishes and maintains an organizational plan.	Audience: The writer provides some information relevant to the needs of the audience.	Language: The writer sometimes provides scientific vocabulary and uses language choices to enhance the text.
Novice 1	Development: The writer provides insufficient scientific facts and concepts to explain the topic. The information provided may be vague or inaccurate.	Organization: The writer either did not establish an organizational plan or, if an organizational plan is established, it is only minimally maintained.	Audience: The writer did not provide information relevant to the needs of the audience.	Language: The writer seldom, if ever, provides scientific vocabulary and uses language choices to enhance the text.